

## SHOCK AS PUNISHMENT IN A PICTURE-NAMING TASK WITH RETARDED CHILDREN<sup>1, 2, 3</sup>

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Two retarded children were taught to name pictures according to a standardized procedure. In Exp. I, correct responses were positively reinforced on a five to one ratio under one stimulus condition, incorrect responses were followed with a sharp "no", and the subject was ignored for inattentive behavior. Under another stimulus condition, correct responses were reinforced as in the first condition, but incorrect responses and 5-sec periods of inattentive behavior were followed by "no" and an electric shock. Less inattentive behavior was exhibited and more words were learned to a pre-set criterion in the shock condition than in the no-shock condition. In Exp. II, the ratio of inappropriate responses to shock was varied. The amount of inattentive behavior tended to increase in the shock condition, relative to that in the no-shock condition, as this ratio was increased. Two other measures of performance used in the present experiments were the ratio of errors to correct responses and the number of correct responses. Shock tended to produce better performance on these measures also.

A reasonable intermediate goal towards developing normal verbal behavior in retarded and autistic children is to establish a large repertoire for naming pictures and objects. A number of studies (*e.g.*, Risley and Wolf, 1967; Wolf and Risley, 1967; Wolf, Risley, and Mees, 1964; Martin, England, Kaprowy, Kilgour, and Pilek, 1968; Lovaas, Schaeffer, and Simmons, 1965), have approached this goal by using positive reinforcement (a) to increase reliably the child's imitation of object names, and (b) to bring the verbal responses so strengthened under the control of the appropriate objects or pictures, while generally using mild punishment to suppress undesirable behavior in the training situation. For

example, Martin, *et al.*, (1968) reinforced desirable verbal responses with tokens backed up with edibles, and concurrently used brief periods of timeout from positive reinforcement as punishment for inattentive behavior and incorrect responses. But to use timeout as a punisher may cause difficulties. Most obvious is the fact that the procedure consumes valuable time. Moreover, a number of studies in the animal literature have indicated that timeout may be positively reinforcing under certain conditions (*e.g.*, Appel, 1963; Azrin, 1961; Thompson, 1964; Thompson, 1965). Steeves, Martin, and Pear (1970) obtained evidence that timeout acted as a positive reinforcer for at least one autistic child during a verbal training task. In addition, an experiment on teaching retarded children to discriminate antonyms by Martin, Moir, and M. Skinner (1970), showed consistencies within subjects but inconsistencies across subjects with respect to the relative effectiveness of two different timeout durations as punishers for errors.

The difficulties associated with attempting to use timeout as punishment suggest that it would be fruitful to examine the effectiveness of other possible punishers. Punishment by electric shock has been used effectively with retarded and autistic children to increase social behavior (*e.g.*, Lovaas, Schaeffer, and

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Simmons, 1965) and to decrease self destructive and other deviant behavior (*e.g.*, Lovaas and Simmons, 1969; Risley, 1968; Tate and Baroff, 1966). (For a review of the effects of punishment on retarded children, see Gardner [1969].) The primary purpose of the present study was to determine whether electric shock might be advantageously used as a punisher for inattentive behavior and incorrect responding in a picture naming task with retarded children.

#### EXPERIMENT I: EFFECTS OF PRESENTING SHOCK FOR INCORRECT RESPONSES AND 5-SEC PERIODS OF INATTENTIVE BEHAVIOR

Azrin and Holz (1966) reviewed the literature on punishment in basic operant research. Extrapolating to practical situations, they concluded that the primary disadvantages of punishment are that the subject may be driven away from the punishing agent thereby destroying the social relationship, and that punishment may produce aggression directed toward the punishing agent or other nearby individuals. Punishment may also elicit emotional behavior that competes with desirable behavior. The strength of these undesirable side effects may be expected to be a direct function of the intensity of the punishment. If a non-punished alternative response is reinforced, mild punishment can be quite effective in eliminating undesirable behavior (Azrin and Holz, 1966) and should minimize the above side effects. Experiment I applied this principle with shock as punishment and compared it with the effects of not using shock.

#### METHOD

##### *Subjects*

Two severely retarded children at the St. Amant Wards of the St. Vital Hospital, Winnipeg, Canada served. Bobby was 6 yr old and had been hospitalized for almost 2 yr. Derrick was 5 yr old, and had been hospitalized for a year before the study began. The subjects would sometimes say "no", "yes", and "bye", and would sometimes mimic simple words if strongly coaxed, but they did not otherwise respond verbally. Typically they played by themselves except when fighting.

##### *Apparatus and Materials*

The research was conducted in a large classroom in the hospital. A subject sat behind a card table, located in a corner of the room to reduce escape behavior. On another table, beside the experimenter who sat opposite to the subject, were a number of picture cards, a desk lamp containing a 60-w red bulb, five small toy plastic bricks, reinforcers (M & M candies, nuts, the evening meal or picture books), a shock apparatus, a session timer, and data sheets.

##### *Discriminative Stimuli*

The cards, 6 in. by 9 in. (15 by 23 cm) displaying colorful pictures of simple objects served as the discriminative stimuli for naming behavior. They were manufactured for use at the first-grade level by the Economy Company, Indianapolis.

In addition to the leads from the shock apparatus, a lamp with a red bulb served as discriminative stimuli to distinguish the two conditions of the experiment.

##### *Reinforcers*

The toy bricks were used as tokens and were exchanged for back-up reinforcers on a 5:1 ratio. The back-up reinforcer for Derrick consisted of two M & M candies or nuts. The back-up reinforcer for Bobby was originally a bite of his evening meal, but was later changed to 15 sec of looking at a picture book. This was done after five sessions of the picture-naming task (see below) because he began refusing a number of food items.

##### *Punisher*

Punishment was delivered by means of the shock apparatus, which consisted of a box containing a 6-v flashlight battery and an auto induction coil, two 10-ft lead wires with a push-button switch on one, and an adjustable elastic strap. The lead wires were attached to the subject's bare calf by means of the elastic strap. The range of the shock as observed by an oscilloscope was from 9 to 15 mA and the duration was approximately 25 msec. No marks were left on the skin where the electrodes were placed. The physical reactions to the shock were mild. Derrick sometimes hit the table with the palm of his hand and Bobby often winced.

### Procedure

*Preliminary training.* Procedures essentially the same as those described by Martin, *et al.*, (1968) were used to train the subjects to sit attentively at a table, to receive tokens (toy bricks) and exchange them for back-up reinforcers on a 5:1 ratio, and to respond adequately to cues that were presented by the experimenter in a word-mimicking and picture-naming task.

Using a standardized procedure, a preliminary test yielded nine known words—*i.e.*, pictures the subjects could reliably identify—and 27 unknown but pronounceable words for Bobby. It yielded 37 unknown but pronounceable words and no known words for Derrick. These words were divided randomly into two approximately equal word pools for each subject. Unknown words in one pool were taught according to one experimental procedure, and unknown words held in the other pool were taught according to another experimental procedure.

*Procedures for the picture-naming task.* The purpose of this experiment, as explained in the introduction, was to compare the effectiveness of two different procedures for teaching retarded children to name pictures. The basic difference between the two procedures was that one involved the use of electric shock as punishment for incorrect responses and inattentive behavior, and the other did not.

Sessions were conducted every other afternoon (Saturdays and Sundays generally excluded). The subject would first receive a 20-min period under the conditions of one procedure, and then after a 10-min break would receive a 20-min period under the conditions of the other procedure. The sequence of the procedures was reversed on each subsequent session.

A picture-naming task (slightly modified from Martin, *et al.* [1970]), with a different pool of pictures for each procedure, was used. The no-shock procedure was as follows:

(a) The experimenter randomly selected an unknown picture from the no-shock word pool and said, "What's that? That's a \_\_\_\_\_ (name of object)." This was called a prompt. If the subject mimicked the name correctly, the experimenter pointed to the picture and asked, "What's that?" This was termed a question. Correct responses to prompts and to

questions were each reinforced with a token. When the subject had accumulated five tokens, he exchanged them for a back-up reinforcer. Incorrect responses or a 5-sec period in which no response occurred resulted in a "no" from the experimenter, and the prompt was immediately repeated. This was continued until the subject responded correctly to the question.

(b) When the subject responded correctly to a question, Step (a), above, was carried out for a known word. (A slight modification of this and following steps was necessary for Derrick because he initially had no known words. This is described later.) Then Step (a) was repeated for the unknown word. The questions for the known word and the unknown word were then alternated until the subject made four successive correct responses.

(c) Step (b), above, was then repeated with a second known picture, and then again with a third known picture.

(d) Steps (a) to (c), above, were then carried out with another randomly selected unknown word.

(e) When Steps (a) to (c) were completed for an unknown word, that word was said to have "reached criterion". When a word had reached criterion it was tested once at the beginning of the next three sessions, or until incorrectly recalled. If it was correctly recalled at the beginning of each of these three sessions, it acquired the status of a "learned word" (and was eligible to be used as a known word). Otherwise it returned to Step (a), above, and the process was repeated. If a given word was not learned after the process had been carried out six times for that word, it was discarded from the experiment. This occurred on three occasions for each of the subjects.

Since Derrick lacked any known words, unknown words were presented with the trials for known words omitted. In seven sessions, three words reached the pre-set criterion of a known word. However, when following the above procedure, Derrick consistently called any unknown word by the name of the known word with which it was alternated. The alternation procedure was dropped, and the unknown words were used alone. The total number of prompts and questions to be presented remained the same, however.

If an incorrect response was emitted, or if no response occurred within 5 sec, the experimenter said "No", and turned his head to one side. If the subject was inattentive—*i.e.*, not focusing his eyes somewhere between the experimenter and the picture, or was emitting vocalizations or fidgeting—the experimenter turned his head to one side and ignored the subject for the duration of the inattentive behavior. Although his head was turned away from the subject, the experimenter watched him closely out of the corner of his eye in order to resume testing as soon as the inattentive behavior ceased. Disruptive behavior—*e.g.*, grabbing at the tokens, attempting to leave the experimental setting—resulted in a sharp slap on the hand. The task was then immediately resumed unless the child was inattentive.

The shock procedure was identical to the no-shock procedure with the following exceptions:

(a) The red light was turned on to provide a discriminative stimulus for this condition.

(b) The shock electrodes were placed on the subject's leg.

(c) After an incorrect response, or a 5-sec interval (as measured by the secondhand of the session timer) in which no response occurred, the experimenter said "No" and delivered one shock.

(d) After each 5-sec interval of inattentive behavior, the experimenter said "No" and delivered one shock. (Disruptive behavior, however, was treated in the same manner as in the No-Shock Procedure.)

*Interobserver reliability.* The picture-naming task required the experimenter to decide whether or not a verbal response emitted by the subject was correct. To check the reliability of these decisions, the subjects' responses were recorded on tape. An observer listened to 283 responses from randomly selected tapes, and judged whether the responses were correct or incorrect. The interobserver reliability measure was the ratio of agreements to agreements plus disagreements taken across both shock and no-shock conditions. The result for the shock procedure was 0.87 and for the no-shock procedure was 0.94.

The experimental procedure also required that the experimenter distinguish between attentive and inattentive behavior. The reliability of this measure was assessed after com-

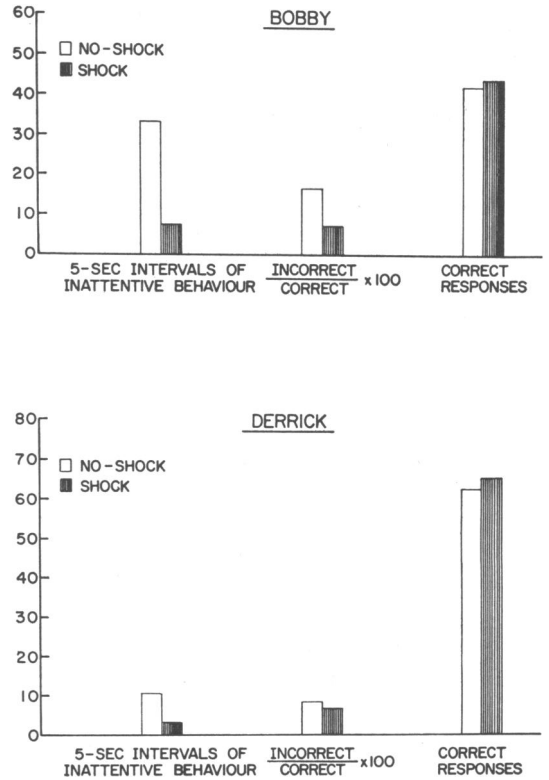


Fig. 1. Means per 18 sessions of several measures for Derrick and Bobby in Exp. I.

pletion of the experiment. During these post-experiment testing sessions, the experimenter operated an electric timer by pressing a button when he judged the subject to be inattentive. An observer operated another electric timer when the subject was inattentive. A third electric timer automatically recorded the agreements on inattentiveness; *i.e.*, the periods of time when both the experimenter's and observer's timers were operating. The ratio of time in agreement to time in agreement plus time in disagreement yielded a score of 0.97 for the shock procedure and 0.98 for the no-shock procedure.

## RESULTS

Figure 1 shows the means over 18 sessions of 5-sec intervals of inattentive behavior, the ratio of incorrect/correct responses, and the correct responses under the shock and no-shock procedures for Derrick and Bobby. Bobby spent markedly more time inattentively, *i.e.*, more 5-sec intervals of inattentive behavior, under the no-shock procedure. Derrick generally had less inattentive behavior

than Bobby but again more time was spent inattentively under the no-shock procedure. The ratio of incorrect to correct responses was higher under the no-shock procedure for both subjects. The correct response measure suggests superiority of the shock procedure because more correct picture naming and mimicking responses occurred for both subjects during that procedure.

Figure 2 shows the cumulative number of words "learned" (as defined in the Procedure section) over sessions during each of the two conditions. The figure begins with Session 4 because the criterion of learning used in this experiment did not permit any words to be learned before that session (see the Procedure section). For both subjects the learning rate was considerably higher during the shock procedure than it was during the no-shock procedure.

There did not seem to be any undesirable side effects from the use of electric shock. Both subjects appeared to enjoy the sessions. They generally ran to the experimenter when he arrived to take them to the experimental room, and it was sometimes difficult to get them to leave after a session. They both rolled up their own pant legs so that the lead from the shock apparatus could be attached. Disruptive behavior after shock was rare. Derrick on occasion, would hit the table following a shock and Bobby winced. However, slapping the subject's hands resulted in much more violent reactions. Following a slap they would sometimes scream and cry, although this behavior usually stopped abruptly when it was ignored.

#### Discussion

The main effect of the shock procedure, relative to the no-shock procedure, was to reduce the amount of session time wasted in inattentive behavior. It also decreased the ratio of incorrect responses to correct responses. Because of these effects, the absolute number of correct responses tended to be increased by the shock procedure and the learning rate produced by that procedure was much higher than that produced by the no-shock procedure (see Fig. 2). The results of Exp. I, then, indicate that mild shock that is used in conjunction with positive reinforcement can be effective in teaching retarded children to name pictures.

Although the shock procedure was generally more effective, its relative success may not justify its use for some subjects in an applied setting. The differences between the means for 5-sec intervals of inattentive behavior indicate that approximately 128 sec per 20-min session were saved by shock in Bobby's sessions and approximately 37 sec per 20-min session in Derrick's sessions. When the ratios of incorrect to correct are compared, Bobby made approximately 9.4 fewer errors per 100 correct per session under the shock procedure while Derrick made 1.5 fewer errors per 100 correct per session. The difference between the means for correct responses in the two conditions was also quite small, as can be seen from Fig. 1. The most appreciable effect of the shock procedure was on the number of words learned (Fig. 2).

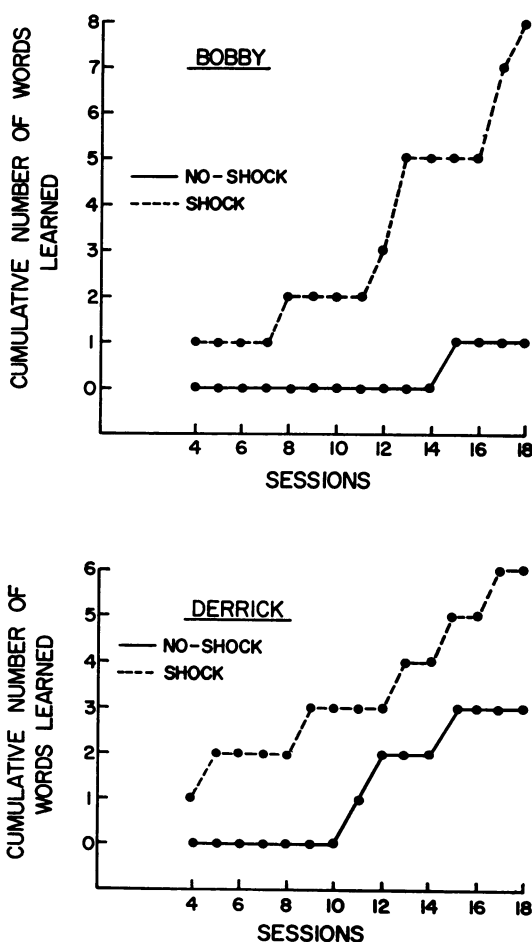


Fig. 2. Cumulative number of words learned by Derrick and Bobby in Exp. I.

## EXPERIMENT II: EFFECTS OF VARYING THE RATIO OF SHOCK PRESENTATIONS TO INCORRECT RESPONSES AND 5-SEC PERIODS OF INATTENTIVE BEHAVIOR

In Exp. I, shock was delivered after each undesirable response. The purpose of Exp. II was to examine the effects of increasing the ratio of undesirable responses to presentations of shock.

The ratios studied here were fixed; *i.e.*, an unvarying number of undesirable responses were required to produce each shock. Fixed-ratio schedules of punishment have been studied in the operant laboratory by Azrin, Holz, and Hake (1963), and Zimmerman and Ferster (1963). The general finding has been that as the ratio of responses to punishments increases, the amount of response suppression decreases (see Azrin and Holz, 1966, page 397).

In the present experiment, each undesirable response was followed by a prominent visual stimulus that was paired with shock. Since the stimulus was paired with shock, it was expected to acquire aversive properties and to function as a conditioned punisher (*cf.* Hake and Azrin, 1965).

### METHOD

#### *Subjects*

Bobby and Derrick continued as the experimental subjects.

#### *Apparatus*

The only apparatus in addition to that used in Exp. I was a 6 by 8 in. (15 by 20 cm) "Magic Slate" on which conditioned aversive stimuli in the form of large, black "Xs" were presented.

#### *Procedure*

The no-shock procedure remained essentially the same as in Exp. I. The shock procedure was altered as follows: following inappropriate behavior (*i.e.*, no response within 5 sec of a prompt or a question, an incorrect response, or 5 sec of inattentiveness), the experimenter said "no" and drew a large "X" on the Magic Slate. The "X" was vigorously drawn and readily visible to the subject. After a set number of "Xs", the experimenter said "no" and a shock was delivered. The slate was erased by lifting the outer page.

For Bobby, the sequence of ratios of inappropriate responses to shock was: 2:1 for 13 sessions; 1:1 (without the "X") for six sessions; and 2:1 for six sessions. For Derrick the sequence was: 2:1 for eight sessions; 4:1 for seven sessions; 1:1 (without the "X") for six sessions; and 4:1 for six sessions. Initially, five books were placed in a stack and the top book was presented when Bobby handed five tokens to the experimenter. At the end of the 15-sec reinforcement period, the book was placed at the bottom of the stack. However, after five sessions Bobby began to refuse some books and to point to others. The procedure was therefore modified so that Bobby was given three books at once. This way he could select the most reinforcing book himself. However, he was still allowed only 15 sec for selection and looking at the book. Another change in Exp. II was that words were taught only to the criterion stage, and were not tested for learning at the beginning of the sessions.

### RESULTS

On all measures for Bobby, as shown in Fig. 3, the shock procedure was more effective than the no-shock procedure only during the 1:1 ratio. For Derrick, the shock procedure was generally more effective than the no-shock procedure on the 1:1 and 2:1 shock ratios. On the 4:1 punishment ratio, the relative effectiveness of the shock procedure was generally reduced.

In Fig. 3, the important comparisons are between the shock and no-shock conditions within each ratio. The absolute fluctuations on succeeding presentations of the same ratios (*e.g.*, note the first and second 4:1 ratios for Derrick) may have been due to baseline shifts related to varying reinforcement potency or other uncontrolled variables.

### DISCUSSION

The results of both Exp. I and II indicate that the main effect of the shock on a 1:1 ratio was to reduce inattentive behavior, while also showing some tendency to increase correct responses and to decrease the ratio of errors to correct responses.

Increasing the ratio of undesirable behavior to shock, in Exp. II, generally decreased the differences between the shock and no-shock procedures. This is consistent with Azrin, *et al.*, (1963) who found that overall response

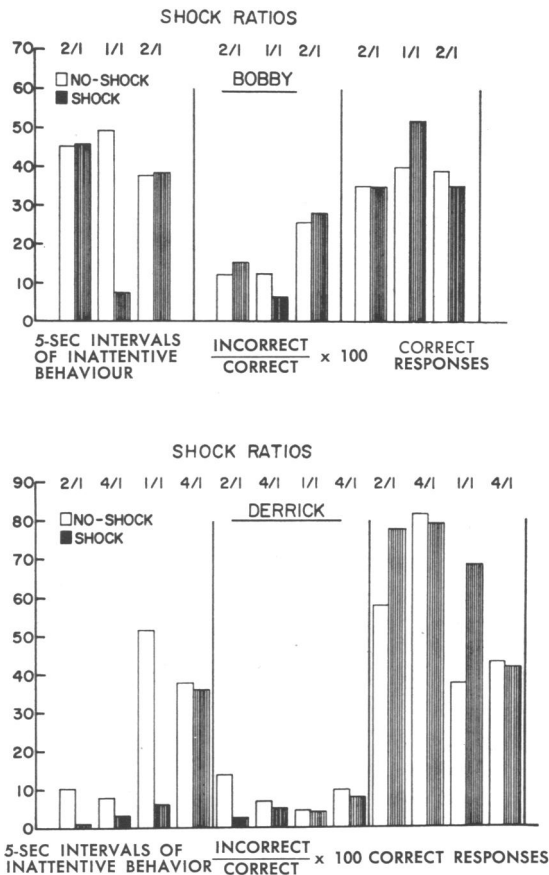


Fig. 3. Several measures under various shock ratios for Derrick and Bobby in Exp. II. Means were computed from the last three sessions in each condition.

rate increased when the ratio of unpunished to punished responses was increased in a basic laboratory situation.

It is interesting to note that the clarity of the results in the present experiment was due largely to the use of a multiple-baseline design. Uncontrolled variables that occurred across days did not interfere with the major conclusions, since the two main procedures were conducted on each day. This design does, however, open the possibility of interaction effects that would not occur if the two procedures were studied in isolation.

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